

Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	I_D
650V	$2.2\Omega@10V$	4A

Feature

- Low $R_{DS(on)}$
- Low FOM
- Extremely low switching loss
- Good stability and uniformity

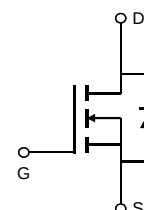
Application

- Consumer electronics power supply
- LED Lighting
- Standby Power
- Charger

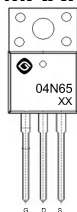
TO-220F-3L



Schematic diagram



MARKING:



04N65 = Device Code

XX = Date Code

Solid Dot = Green Indicator

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain - Source Voltage	V_{DS}	650	V
Gate - Source Voltage	V_{GS}	± 30	V
Continuous Drain Current ^{1,6}	I_D	4	A
Pulsed Drain Current ²	I_{DM}	16	A
Single Pulsed Avalanche Current ³	I_{AS}	4.1	A
Single Pulsed Avalanche Energy ³	E_{AS}	252.1	mJ
Power Dissipation ^{5,6}	P_D	38.5	W
Thermal Resistance from Junction to Ambient ⁶	$R_{\theta JC}$	3.25	$^\circ\text{C/W}$
Junction Temperature	T_J	150	$^\circ\text{C}$
Storage Temperature	T_{STG}	-55~ +150	$^\circ\text{C}$

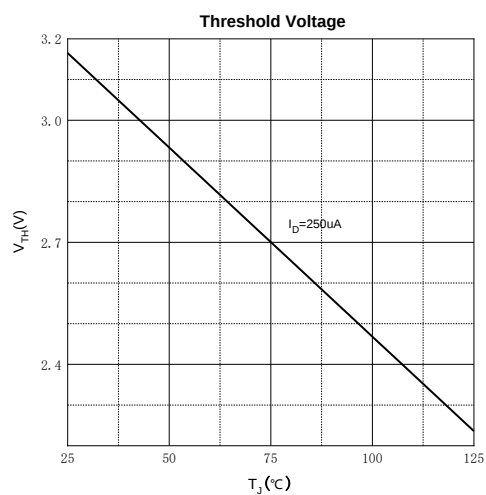
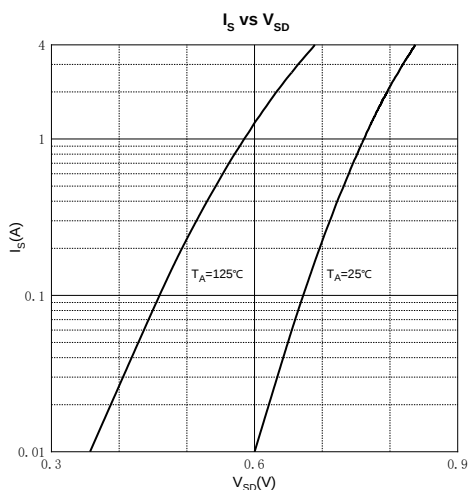
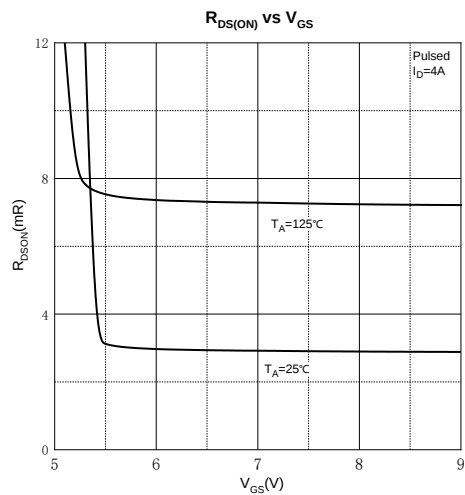
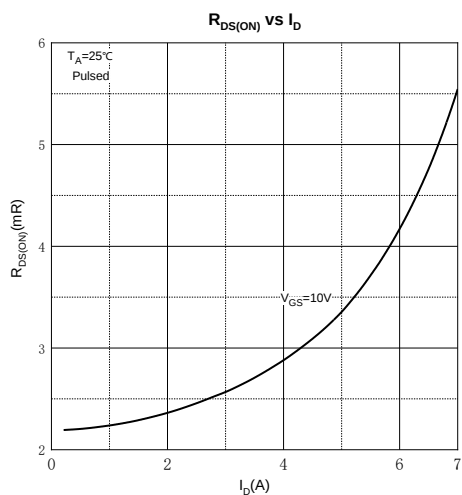
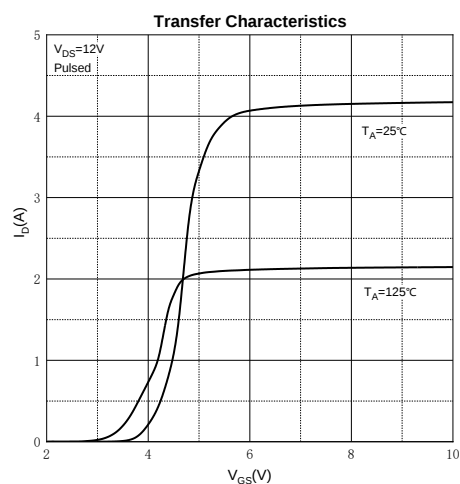
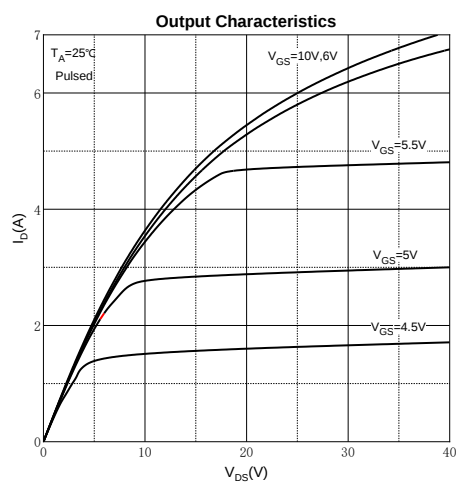
ELECTRICAL CHARACTERISTICS (T_a=25°C unless otherwise noted)

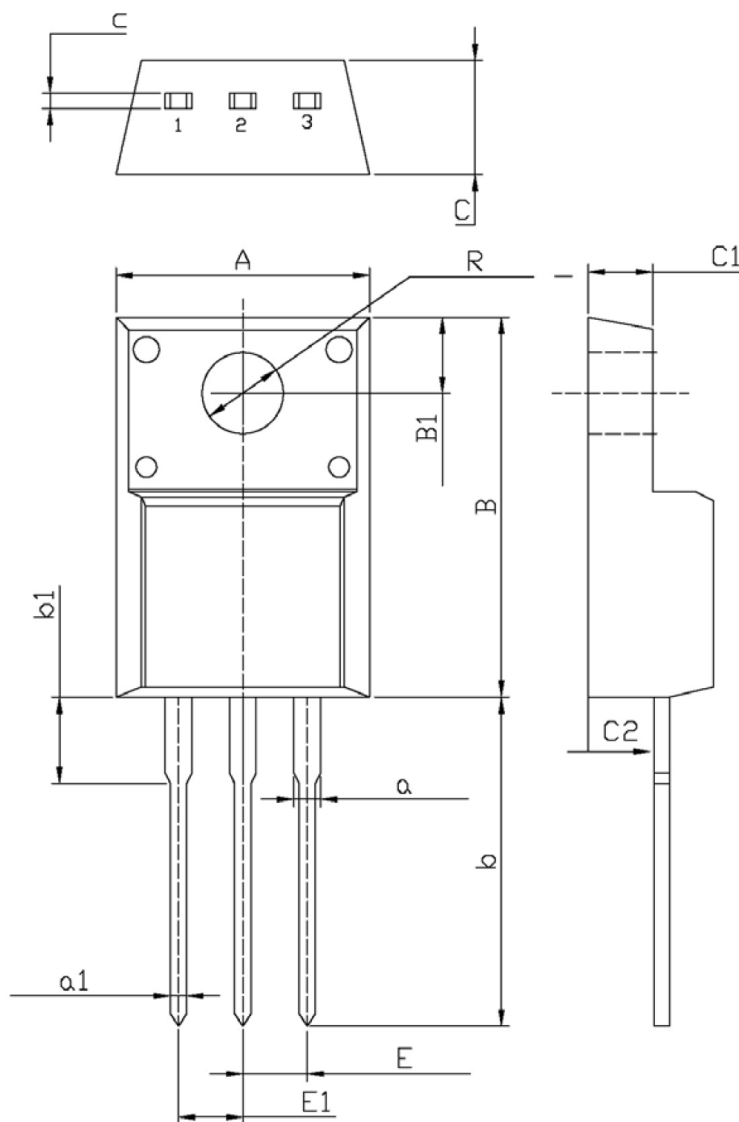
Parameter	Symbol	Test Condition	Min	Type	Max	Unit
Static Characteristics						
Drain-source breakdown voltage	V _{(BR)DSS}	V _{GS} = 0V, I _D =250μA	650			V
Zero gate voltage drain current	I _{DSS}	V _{DS} =650V,V _{GS} = 0V			1	μA
Gate-body leakage current	I _{GSS}	V _{GS} =±30V, V _{DS} = 0V			±100	nA
Gate threshold voltage ^(note1)	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	2.0	3.0	4.0	V
Drain-source on-resistance ^(note1)	R _{DS(on)}	V _{GS} =10V,I _D =2A		2.1	2.4	Ω
Forward transconductance ^(note1)	g _{rs}	V _{DS} =50V, I _D =1A	1			S
Dynamic characteristics ^(note2)						
Input Capacitance	C _{iss}	V _{DS} =25V,V _{GS} =0V,f =1MHz			565	pF
Output Capacitance	C _{oss}				135	pF
Reverse Transfer Capacitance	C _{rss}				15	pF
Total Gate Charge	Q _g	I _D =4A,V _{DS} =480V,V _{GS} =10V		4	8	nC
Gate-Source Charge	Q _{gs}			2		nC
Gate-Drain Charge	Q _{gd}			1.5		nC
Turn-on delay time	t _{d(on)}	V _{GS} =10V,V _{DS} =300V, R _G =9.1Ω,I _D =4A			15	ns
Turn-on rise time	t _r				8	ns
Turn-off delay time	t _{d(off)}				30	ns
Turn-off fall time	t _f				15	ns
Source-Drain Diode characteristics						
Diode Forward voltage ^(note1)	V _{SD}	V _{GS} =0V, I _S =2A			1.5	V

Notes :

- 1.The maximum current rating is limited by package.
- 2.Pulse Test : Pulse Width ≤ 10μs, duty cycle ≤ 1%.
- 3.EAS condition: V_{DD} = 100V, V_{GS} = 10V, L = 30mH, R_G = 25Ω Starting T_J = 25°C.
- 4.Pulse Test : Pulse Width ≤ 300μs, duty cycle ≤ 2%.
- 5.The power dissipation P_D is limited by T_{J(MAX)} = 150°C.
- 6.Device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A = 25°C.

Typical Characteristics



TO-220F-3L Package Outline Dimensions


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
C	4.500	4.900	0.177	0.193
c	0.400	0.600	0.016	0.024
A	9.960	10.360	0.392	0.408
B	15.670	16.070	0.617	0.633
B1	3.300	3.500	0.130	0.138
R	3.080	3.280	0.121	0.129
b	12.480	13.480	0.491	0.531
b1	2.900	3.900	0.114	0.154
a	1.080	1.480	0.043	0.058
a1	0.700	0.900	0.028	0.035
E	2.340	2.740	0.092	0.108
E1	2.340	2.740	0.092	0.108
C1	2.340	2.740	0.092	0.108
C2	2.560	2.960	0.101	0.117